

CLAIMS

What is claimed is:

5 1. A phase shifter circuit for imparting a phase shift to a signal applied at an input port such that the phase shifted signal appears at an output port, the circuit comprising:
an input port coupled to receive the input signal;
an output port coupled to provide the phase shifted output signal, the output port coupled to the input port, such coupling between the input port and output port having a characteristic input/output impedance;

10 a first quadrature port and a second quadrature port, the first and second quadrature ports coupled to one another, such coupling between quadrature ports having a characteristic quadrature port impedance, being different from the input/output port impedance;

15 a first impedance transformer coupled between the input port and a first one of the quadrature ports, the first impedance transformer transforming the characteristic input/output impedance across the input/output ports to the characteristic quadrature port impedance across the quadrature ports; and
a second impedance transformer coupled between a second one of the quadrature ports and the output port, the second impedance transformer transforming the characteristic quadrature port impedance across the quadrature ports to the characteristic input/output impedance.

20 2. An apparatus as in Claim 1 wherein the coupling between the input port and output port is provided by a branch line having the desired characteristic input/output impedance.

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3. An apparatus as in Claim 2 wherein the coupling between the quadrature ports is provided by a branch line having the desired characteristic quadrature port impedance.

4. An apparatus as in Claim 1 wherein the coupling is provided by coupled lines.

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5. An apparatus as in Claim 1 wherein the coupling between the quadrature ports is provided by coupled lines.

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6. An apparatus as in Claim 1 wherein the first impedance transformer is implemented as a one-quarter wavelength section of transmission line.

7. An apparatus as in Claim 1 wherein the second impedance transformer is implemented as a one-quarter wavelength section of transmission line.

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8. An apparatus as in Claim 1 wherein a varactor diode is coupled to at least one quadrature port.

9. An apparatus as in Claim 1 wherein a varactor diode is coupled to each of the quadrature ports.

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10. An apparatus as in Claim 8 wherein an input bias voltage is applied to at least one of the varactor diodes.

11. An apparatus as in Claim 9 wherein the voltage of the input bias voltage determines an amount of phase shift imparted by the phase shifter.

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12. An apparatus as in Claim 1 wherein the characteristic input/output impedance is 50 ohms.

13. An apparatus as in Claim 1 wherein the characteristic quadrature port impedance is 20 ohms.

14. An apparatus as in Claim 1 wherein a Radio Frequency (RF) choke is applied between the bias voltage port and one of the quadrature ports.

15. An apparatus as in Claim 1 wherein the characteristic quadrature port impedance is lower than the characteristic input/output port impedance.